ACORN COMPUTERS LIMITED

TRAINING DEPARTMENT

STUDENT NAME:

COURSE:

A number of useful improvements to our training courses have arisen from helpful suggestions given to us by course members. We therefore invite you to describe below any suggestions to improve subsequent courses:

Signed .... Date ....

AN INTRODUCTION TO THE ECONET SYSTEM - TIMETABLE

09.30 Introduction

09.45 ECONET - component parts

10.45 Coffee

11.00 Level 1 file server

Facilities common to both Level 1 and Level 2

Level 1 file server - demonstration and practical

12.30 Lunch

14.00 Printer Server

Level 2 file server

15.15 Tea

15.30 Level 2 file server (continued)

17.00 Finish

DETAILED TECHNICAL DESCRIPTION OF THE ECONET SYSTEM - TIMETABLE

09.30 Data transfer across the network

10.45 Coffee

11.00 Data transfer (continued)

ECONET hardware

Level 2 file server - demonstration and practical

12.30 Lunch

14.00 Basic (primitive level) operations

15.15 Tea

15.30 Locating causes of faults in the network

ECONET test aids

16.30 Question time

17.00 Finish

The Econet Maintenance Aid - EMA

A new test aid for Econet dealers has been introduced by Acorn. It is a portable, self contained, battery powered unit, which together with a DMM and battery powered oscilloscope allows fast fault diagnosis to be made on networks.

The EMA will perform three types of test:

a) Indicator

This function is used to display the logic state of the Data and Clock lines. The indicator is entirely passive but can be switched out to avoid interference with reflection or resistance tests.

b) Lead Test

This enables cables and leads to be easily tested for shorts, open circuits or cross wires. Each wire can be tested separately,including the screen, by selection with the rotary switch. LED indicators are used to check the wire.

c) Pulse Generator

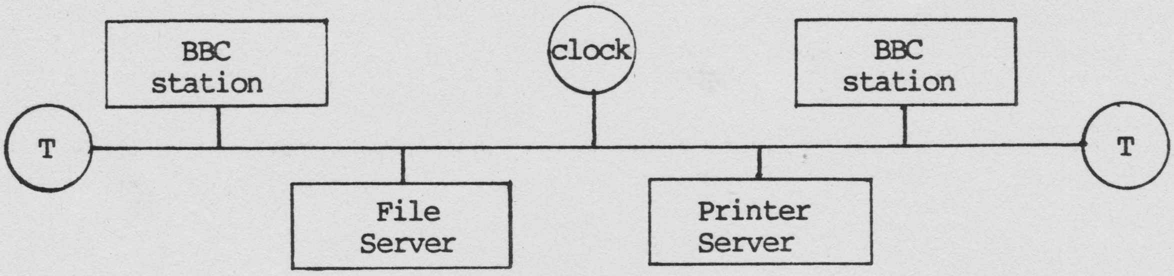
This is used to test for an open circuit, short circuit, or low impedance device connected to the network. It is particularly useful to check for faults in inaccessible parts of the network. Pulses can be injected on the wire selected by the rotary switch and the reflections displayed on an oscilloscope which is used to locate the position and type of fault.

The EMA is provided with a useful manual giving information on maintenance of the network as well as detailed instructions on the use of the EMA.

INTRODUCTION TO ECONET

EQUIPMENT REQUIRED

An Econet system consists of a number of units configured like this:



Econet workstation

This is normally a BBC computer fitted with an Econet interface and a ROM holding the Econet software. This station can then talk to other stations in the network and share network facilities such as disc drives and printers.

File server station

This is a BBC computer dedicated to running a program called the file server. All workstations in the network can access the disc storage associated with this file server.

Currently Acorn support two levels of file server which provide different levels of service to the network user:

- file server level 1 runs on a model B BBC computer fitted with Econet and disc interfaces and either a single or dual disc drive.

- file server level 2 requires in addition a 6502 second processor. The disc drive must be dual.

Printer server station

This is a BBC computer fitted with an EPROM containing the printer server program, and (obviously!) having a printer attached. All the work stations in the network can then share the use of this printer. The software is optimised to print as much as possible from one station before handing control to another.

Since printing takes place as a background task, it is possible for this station to be used as a workstation. However, great care must be exercised in this case, since:

- use of the BREAK key disenables the printer service
- printing from that station over the network (to itself) is not possible.

Cables

Acorn supply the cables used to link the components in the network in two formats:

- 10 station lead set. This modular cable system is suitable for networks up to 30 metres long with up to 10 stations (including file server and printer server).
- Econet cable. Dual twisted pair cable with a core diameter of 0.9mm, this is suitable for networks of up to 500 metres. It assumes the network will be "permanent", and caters for up to 254 stations.

Clock box

The clock box generates a signal which synchronises all data transferred on the network; in other words, it enables all the stations to operate at identical speed. For best results, especially in a large network, the clock should be attached at approximately the middle of the cable.

Terminator boxes

A terminator is required at each end of the cable to prevent reflections on the line and to provide signal conditioning.

LEVEL 1 FILE SERVER

This is simple, easy-to-use and very similar to an ordinary DFS system. The file server program is written in BASIC and is ideal for those who want a few powerful facilities together with the ability to share hardware devices such as disc drives or printers.

The file server station is a Model B BBC computer with Econet and disc interfaces. The disc drive can be single or dual, 40 or 80 track. A network can support up to 254 stations including any combination of file servers, printer servers and work stations.

The system caters for two types of files:

- library files which are freely available to anyone on the network and
- user files which are secure against access by other network users.

Each user of the system is allocated a single character directory name. Directories can be shared or available to just one user. The requirements for a particular session are entered when the system is powered up. A file can be maintained holding the details to avoid the need to key in the information each time.

Example:

Terminal id	User	Directory
001	Jones	A
007	Smith	B
023	Brown	A

Here Jones and Brown are able to use the same files (those in directory A and all library files). They cannot access Smith's files in Directory B. Indeed, only Smith can get at them. In a classroom environment, it is likely that directories are shared extensively.

It should be noted that the DFS limit of 31 files per disc surface likewise applies in an Econet system. Hence in a single drive situation, users of a network may be constrained to a total of 31 files, including library files, and a total storage capacity of 100K. For a dual drive 80 track system, this increases to 124 files and 800K store per file server. The system manager has the task of allocating files to each user.

Commands available when using level 1 file server

LOAD, SAVE, *LOAD, *SAVE, *DRIVE - as normal
*DELETE - as normal (files in your directory only)
*CAT - entered in same way as normal, eg *CAT 1, giving:
(a) Catalogue header
(b) Files within your directory on drive 1
(c) Library files on drive 0 (ie files in directory &)

*ACCESS, *INFO - as for DFS. Restriction: wildcards are not available

*VIEW - takes a snapshot of what is happening at another terminal. Note that you may have to change MODE before this command will work. This command is only available to stations with access to the library containing it (eg all stations if in library &).

*NOTIFY - enables a single line message to be sent from one station to another. The message goes into the keyboard buffer of the receiving machine and a beep occurs. The number of the sending station is printed together with the message. A carriage return is not printed, so the message can be deleted before the recipient continues to type in at his keyboard.

*REMOTE - gives you complete control of a distant machine, disenabling it completely. Even switching off the remote machine and switching on again will fail to sever the connection!

*ROFF - terminates the use of the remote facility.

*PROT - protects the machine against *REMOTE, *VIEW, and *NOTIFY. Any station trying to access a protected machine gets a NOT LISTENING error message.

*UNPROT - removes protection.

System Manager

Econet is a multi-user system. Administration of the system is carried out centrally and, unlike single-user systems, users do not do their own backing up and formatting of discs. The successful operation of each user station depends on the whole system being set up and maintained correctly.

Every Econet system needs a manager who is responsible for the day to day running, administration and maintenance of the entire network, and is available to answer queries and sort out any user problems. Each time the network is switched on he must ensure that all the equipment is functioning correctly and is ready for use.

There are a number of administrative tasks to be carried out, such as regularly updating and backing up library files and data discs. Security is also very important and access to the file server machine should be restricted to those authorised to use it, so that users' files are secure.

Start of day procedure

1. Ensure all computers, terminators and the clock are correctly plugged into the network sockets and that all connections between units (eg file server station to disc drive unit) are correct.

2. Check all units requiring mains electricity are correctly plugged into the mains. Switch on the mains supply and check that the red lights on the clock and terminator units are on.

3. Switch on the file server station. NB - This should be in DFS, not network mode.

4. Run the file server program, CHAIN"FS". A question and answer session follows! You state the maximum number of files that may be allocated to each user for this session. Next you assign a directory letter to each user station. All files subsequently created at that station will be stored under this letter and can only be retrieved by a station with the

corresponding directory letter. The question actually asked is "Manual?" If you are going to type in all the details manually at this point, say "Yes"; if they are already stored on disc (see NAMES file below), answer "No".

5. Once directory/station details have been entered, press RETURN and the Econet service is now available from every station named in the set-up procedure. You should now insert the work disc(s) required for the session. Note that now the file server program is running, its station keyboard should NOT be used.

6. Switch on each user station in turn and activate the Econet software.

NAMES file

The NAMES file is used for storing a list of all current user stations and their file directory letters. In a system with a number of user stations a great deal of time can be saved by letting the computer allocate stations to directories automatically each time the file server is set up.

This file is updated by running the utility program FSUTIL. The first time it is used, prompts appear for directory and station numbers as when running FS with MANUAL=Y.

When FSUTIL is run subsequently, the current situation is listed. You can add new stations by typing in their directory and station number, and delete any stations already in the list.

Error messages

When the system is being powered up, one of the following messages is displayed if an error occurs:

NO CLOCK : no clock signal is reaching the computer. Check:

- a "genuine" clock IS connected correctly to the network and switched on
- the computer giving the message is plugged into the network correctly
- whether all stations are giving the error, or just one
- network and connecting cables

NO NAMES FILE : check that the correct disc has been loaded

NOT LISTENING : file server has rejected your request. Check that:

- the file server program is running
- file server has station number 254; if not, specify its number with I AM
- station is plugged correctly into the network cable
- if to a printer, that the printer server has been enabled

NO REPLY : file server not responding to your request. Check:

- disc drive connected and working
- printer server has not been disconnected

LINE JAMMED : data is continuously present on the network data lines

- normally caused by a faulty machine

NET ERROR : error occurred during transmission. This may be due to an unsuitable clock speed for the network, a fault in a terminator or a fault in the network cable.

PRINTER SERVER

The printer server is a discrete entity. Consequently it is used identically with either file server 1 or 2. The default station number is 235 giving the printer relatively high priority while allowing several file servers to be set up with higher numbers.

The printer server is an Econet station. The software is provided as an EPROM fitted into one of the sideways ROM sockets. In addition, the station number of the printer server has to be set up.

When switching the printer into the network at the beginning of the day or during a session, type at the printer server station:
- system reset (BREAK)
- *FX5,1 or *FX5,2 to select parallel or serial interface
- *PSERV to start the printer server program and prepare it to accept output from OTHER stations.

The control characters required for printer commands such as "underline", "bold" or "double height" depend on the make of printer. The *PSERV command can also be used to pre-program the printer server for certain printers. Currently the ones available are:

1	Olivetti JP101
2	Epson MX-80 and FX-80
3	Walters Microsystems WM2000
4	Mannesmann-Tally MT180
5	Mannesmann-Tally MT140
6	MPG994

For example, to tell the printer server to use an Epson MX-80, enter *PSERV 2. In addition, this sets up default values for control information printed before and after text.

Using a printer from an Econet station

Once a printer server has been activated, each station uses it as if it had its own printer attached, though sometimes you may have to wait because the printer is already in use.

If there is more than one printer server in the network, you specify the one you wish to use by entering *PS ps number. (By default 235 is assumed.) The first time in a session you wish to use a printer, enter *FX5,4 to tell your station to use the network printer, not a local one.

From now on printing takes place in the normal way, initiated by CTRL/B or VDU2 and terminated by CTRL/C or VDU3. If someone else is using the printer, your station will attempt to access the printer for 30 seconds, and if still unsuccessful, will give a NOT LISTENING message. Save your output for printing later.

To assist splitting up the printout at the end of a session during which several stations have used the printer, each chunk of text is sandwiched thus:

BANNER (eg Econet station 123)
text
ENDTEXT (eg two form feeds)

Selecting the printer with the *PSERV command (the Epson in our earlier example) generates standard default values for BANNER and ENDTEXT. Alternatively, you can go for a DIY approach:

*PRE string - sets up control characters for use in the banner (eg give 10 linefeeds and then print (banner) double height.

*BANNER string - says what is to be printed in the banner (max. 64 characters). If station 123 gives the command *BANNER 1st January 1984 the header will be:

1st January 1984 ** Station 123 **

printed as per the control characters (eg double height) of *PRE.

*POST string - enables you to reset the print control characters for the main body of text.

Your text appears at this point.

*ENDTEXT string - specifies what is to be appear at the end of this piece of work (max. 64 characters). Typically it will include line or form feeds.

Optimisation

The printer server strives to reach a compromise between interleaving lots of small amounts of printing from stations, and one station "forgetting" to switch off the printer although no longer required, and hence preventing others accessing it. The compromise involves dedicating the printer to a station until that station says it has finished, or until it has not used the printer for 30 seconds. At this point it is "timed-out". If the same station is next to issue a print command, fine! If not, the ENDTEXT routine for the relinquishing station is obeyed, and printing for the new station commences with its banner and text.

LEVEL 2 FILE SERVER

Although the Level 1 file server's facilities are all that many users need, others require a more advanced/sophisticated approach. This is provided by the level 2 file server, which in addition to providing all level 1 facilities, offers:

- random access to data files
- password protection at log on
- greater control of public and private access to files
- number of files or directories limited only by maximum disc storage
- hierarchical directory structure
- extended library facilities
- system privilege commands to control network facilities.

An end user's session

The session starts in a nice, friendly way with the question WHO ARE YOU? The user replies:

```
*I AM name password
```

"Name" is the user's identifier (up to 10 characters) previously assigned by the system manager and placed by him in a password file (similar to the level 1 NAMES file). The default password is the null string. It is up to the user to:

- choose his own password
- tell the system what it is
- prevent anyone else finding out and
- remember it!

Passwords are changed with the command:

```
*PASS old new
```

For example, *PASS "" SECRET will change the default password to SECRET. Passwords have a maximum of 6 characters.

At the end of a session, a user logs off with the command *BYE.

Once logged in, a user can give the commands LOAD, SAVE, *LOAD, *SAVE, *DELETE, *INFO and *CAT. The catalogue in level 2 contains:

- catalogue name
- disc name
- directory name
- owner (of files being looked at)
- option
- currently selected library
- each file's name plus privacy access.

A user specifies the option he wants by giving the command *OPT 4,n where n is in the range 0 to 3:

- 0 : nothing
- 1 : *LOAD !BOOT into memory at its load address
- 2 : *RUN !BOOT as a machine code file
- 3 : *EXEC !BOOT

Files with their privacy access appear in the catalogue listing thus:

```
MATHS       LR/
MYPROG      WR/R
```

R stands for read, W for write, and L for lock. The owner's privacy is given before the / symbol, that assigned to other users after it. So, file MYPROG can be accessed at will by its owner, be it for reading or updating; other users can also access it but only for reading. File MATHS, on the other hand, can merely be read by its owner. Since it is locked, it cannot be accidentally deleted. Files are saved with a default access of WR/ - the owner can do what he likes with the file, but no-one else can get at it (unless it is in public storage). The *ACCESS command is used to change the privacy associated with a file.

Directories

A hierarchy of directories can be created and maintained. The base of the hierarchy on each disc is the ROOT directory, which is created on the disc when it is initialised. Usually the system manager will place one entry for each user of the disc in the root directory. The user can then make this the base for his own hierarchy of files and directories.

The command *CDIR is used to create a new directory. For example, a user may decide to keep his data and program files separate:

```
*CDIR PROGS
*CDIR TEXT
```

To use these new directories, the user will need to include them explicitly in his commands, such as SAVE "PROGS.FUPD" or SAVE "TEXT.WP1". If you are likely to be working with files in a particular directory for some time, it is convenient to tell the system that from now until further notice that directory is to be assumed. This is done by the *DIR command, so the same affect as above can be achieved by:

```
*DIR PROGS
*SAVE "FUPD"
```

As the number of programs in directory PROGS grows, the user may decide to subdivide this directory into (say) PROGS.WORK and PROGS.GAMES. Gradually the hierarchy will grow.

Commands available at system manager's discretion

Certain commands are loaded and executed from a library. Consequently the system manager can decide which to make generally available, which to certain users only.

*USERS - lists the users currently logged onto the network. Each entry specifies station number, user's name and privilege.

*DISCS - names the discs currently in use and the drive each is in.

*SDISC - When a user logs on, the file server selects a disc for him by searching each disc on the system for a directory in the root which is the same as the user identifier. If found, that disc becomes the user's currently selected disc; otherwise, the disc in drive 0 is selected. *SDISC enables the user to select a different disc.

*FREE - This command can be used from any station to give the title of the disc which that user is logged onto, and the amount of free space remaining (in blocks of 256 bytes).

SYSTEM PRIVILEGED USER

A system privileged user has three facilities denied to ordinary users:

- ownership of the root directory on any disc
- the ability to create and delete users
- the ability to grant privilege to other users.

Typically just one person in a network will have this privilege. He owns EVERYTHING - the root directory and everything lower. Only a system privileged user can issue the commands:

*NEWUSER - create new user
*REMUSER - remove user

These merely update the password file; all old disc files are left intact. This is of significance if a user "forgets" his password - the system manager can remove and reinstate him thus:

```
*REMUSER DAVE
*NEWUSER DAVE
```

User DAVE now has the null string default password. He can select a new one with *PASS. In this case a directory entry exists on disc for DAVE (from before *REMUSER). Consequently *NEWUSER takes that. Otherwise DAVE would be allocated to the root directory with read-only access to files.

*PRIV - this command is used by a privileged user to allocate or remove system privilege to/from other users. Hence:

```
*PRIV DAVE S
*PRIV JIM
```

makes JIM an "ordinary" user, and DAVE system privileged.

SUPERVISING A LEVEL 2 FILE SERVER

The system manager is responsible for the day-to-day smooth running and the efficiency of the network. This includes:

- knowing how to handle discs
- initialising discs for use within the system
- carrying out start-of-day procedures
- creating and maintaining the password file
- creating/ deleting users
- organising archiving and back-up procedures
- organising the physical security of the system

Discs

The level 2 file server uses a different file system to that of the System DOS and BBC Microcomputer DFS. Consequently discs in DFS format cannot be used with the file server and vice versa.

Two discs are provided with an Econet system:

The network utility disc is a DFS disc containing:

- the File Server (FS) program itself
- the disc initialisation program for preparing discs for use in the network
- further utilities (eg NETMGR) provided for the smooth running of the file service.

The File Server Master Disc contains:

- utilities for use from the workstations (eg *VIEW, *REMOTE)
- the password file
- demonstration programs

Loading the File Server program at start of day

1. Insert the Network Utility Disc.

2. With computer in DOS mode, issue the *FS command. The File Server:

- tests all the memory
- asks for the date (DD/MM/YY) so that all future files can be date stamped.
- asks how many drives your system has. NB The level 2 file server treats BOTH sides of a disc as a SINGLE entity.

3. At this point the File Server asks you for one of a number of options:

S - start the service
C - convert a DFS disc
Q - quit
A - again, ie return to DATE prompt
ESC - exchange discs
M - switch monitor listing on/off

If you are about to reply S, start the service, make certain at this point that the Utility Disc has been removed, and that each drive contains a disc in File Server Format (see below). On replying S, you will be prompted for the maximum number of users you expect to have in the system during this session, so that the File Server can optimise on the use of available store.

The file server should reply with the cache size and the message "STARTING - READY" and the Econet system is now ready for stations to log in. The cache is an area of memory used to hold files which are accessed frequently so that the number of disc accesses can be minimised, and the file service optimised.

Note that the service will only start if a password file in on-line, since there would otherwise be no means of checking users who attempt to log on.

The command to give at the end of a session is Q for quit. NB NEVER SWITCH OFF WITHOUT FIRST ISSUING Q. To optimise resources, the file server keeps data in its buffers for as long as possible, writing to disc only when essential. So, 20 consecutive updates applied by a user to the same block of data should result in only one physical write. This therefore means that at the end of the user session, the buffers have to be flushed. Q initiates this. Only when the file server tells you it has finished is it safe to remove discs and switch off.

Similarly, suppose you need to switch discs during a session. Updates may likewise be waiting in store. Press ESC. The system will ask which drive is to be changed - say, drive 1. The system then flushes the buffers for that drive and tells you when to load a new disc and continue.

Initialising file server discs

So that the file server can support many users on one disc, several data structures are required on that disc before it can be used. Initialisation is carried out by the utility program DSCMGR. Not merely does this format the disc, but it also creates a password file if required.

To run the program, insert the Network Utility disc into drive 0 and give the command CHAIN "DSCMGR". You will be asked which facility you require. Press I for initialisation and insert the disc to be initialised into drive 1.

The program formats each track in turn on both sides of the disc. You will be prompted for the disc name. This is the one which users will give later when they want to select this particular disc.

You will be asked whether this disc is to hold a PASSWORD file. If you say YES, you next enter the user identifiers of up to 13 users you wish to log on to your file server using the password file on this disc. Default null string passwords will be allocated. On completion, the disc is ready for use.

Managing the PASSWORD File

So that the file server can check users' passwords when they log on, a password file must be on-line. The system manager is responsible for ensuring this.

Typically just one password file will be maintained, located on a "master" disc and permanently loaded in drive 0, with supplementary discs (without password files) using the other drive(s). When a password has to be checked, the file server looks first at drive 0, then drive 1, and so on, until it finds a password file. Coonsequently if two discs both with password files are in the system at once, the one in the lowest numbered drive takes precedence.

If a user forgets his password, it is up to the system manager to recover the situation by deleting and re-creating the relevant user identifier (see page 11 above).

During the lifetime of an Econet system, the number of users will inevitably grow. When the time comes to extend the password file, run the utility program NETMGR, described next.

The NETMGR Utility

This utility has been specially written to perform many of the tasks which a system manager needs to perform to keep the file server running smoothly.

To use this utility, log on, select the root directory and give the command CHAIN "NETMGR". A menu will be displayed, giving you the choice:

N - create new user(s) (cf the *NEWUSER command)

R - remove a user. NB: The *REMUSER command merely updates the password file; NETMGR additionally erases that user's directories and files.

C - copy directory. This enables the entire contents of a directory to be copied to another directory on the same or a different disc. If the copying is to a new disc, the program also reorganises the files in the directory so that they are stored in sequence for faster access. Note that this utility copies the directory even if one of the files contains a disc error, so it can be used to salvage everything on a damaged disc which is not corrupted.

T - print out the directory tree. This enables you to display on the screen (and, if required, take a hard copy of) the tree structure of a directory. All filenames and directory names are printed.

W - wipe directory. This is a command to use with caution! It is used to deleta a directory AND ALL ITS CONTENTS... Make certain before using it that there is nothing in the directory you still need. Since the program unlocks the directory, it cannot be protected from deletion.

Q - quit this program.

In each of the above commands, the full hierarchical name is required, for example, $.MATHS.ALGEBRA where ALGEBRA is the required directory. If, when copying, a different disc is required, the full name is preceded by a colon and the disc name, as in :FORM2A.$.MATHS.ALGEBRA

Privileged Users

Reference has already been made to privileged users and the fact that they can only be created by an existing such user. How do we create one in the first place!? Whenever a password file is created, the system automatically includes a system privileged user called SYST. Immediately the system manager has created a password file, he should set a password for SYST which only he knows, thereby preventing anyone logging on as SYST with complete access to all discs in the system.

Once SYST has served its purpose, namely, creating another system user and/or converting files (see below), it is advisable to remove user SYST completely or, at the very least, make SYST unprivileged.

Converting files from DFS to FS format

File conversion takes place under file server control. Load the file server program in the normal way and answer C to the COMMAND prompt. The system prompts for DRIVE and SIDE. Normally the disc to receive the FS format files will be in drive 0 with the DFS disc in drive 1. The system displays the DFS catalogue and, taking each directory in turn, asks for the destination directory. Note that its full pathname is required. Up to 7 directories can be handled at a time. If a directory does not exist, it is created. To ignore a directory, merely press RETURN.

Note this opportunity to tidy your system as you switch from DOS to FS. It is well worth spending time planning ahead prior to tackling conversion.

Archiving

One of the most important duties of the system manager is to make copies of the file server discs on a regular basis.

Backup in a file server environment is performed by the utility DSCMGR.

Put the Network Utilities disc in drive 0, and the new disc in drive 1. Give the command CHAIN "DSCMGR". When prompted, replace the Network Utilities disc by the disc to be backed up. You will be given the options of formatting the backup disc and of naming it. We recommend that the backup and master discs have different names to enable them to be distinguished easily.

Careful records should be kept showing which disc is which!

The utility automatically copies both sides of the discs - an essential factor for File Server 2.

Once the copying has been completed, the utility gives you the option of futher copying (C), disc initialisation (I) or quitting (Q).

Physical Security

The system manager is responsible for the physical security of the system. This includes preventing unauthorised access to the room containing the fileserver station (eg innocent use of that keyboard could crash the system with the loss of file updates) and ensuring that master discs are neither removed nor copied.